

Bateman HL, McCracken GI, Thomason JM, Ellis JS.

[Learning outcomes: Exploring implications of adopting a different level of detail.](#)

***European Journal of Dental Education* 2016**

DOI: <http://dx.doi.org/10.1111/eje.12246>

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DOI link to article:

<http://dx.doi.org/10.1111/eje.12246>

Date deposited:

15/02/2017

Embargo release date:

29 November 2017

This is the accepted version of the following article

Bateman, H. L., McCracken, G. I., Thomason, J. M. and Ellis, J. S. (2016), Learning outcomes: Exploring implications of adopting a different level of detail. *European Journal of Dental Education*.
doi: 10.1111/eje.12246

which has been published in final form at <http://onlinelibrary.wiley.com/doi/10.1111/eje.12246/full>

Title

Learning outcomes: exploring implications of adopting a different level of detail

Running Title

Learning outcomes

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Keywords

Programme development

Learning outcomes

Acknowledgements

None

Learning outcomes: exploring implications of adopting a different level of detail

'Conflict of Interest'

All authors declare there are no conflicts of interest in relation to this study.

Abstract

Introduction: Outcome based programmes provide a framework to support educators and learners in understanding content and end points within taught courses. Management of these outcomes in the Dental Degree at Newcastle University, has been a challenge in relation to quality assurance and enhancement, having over 1500 detailed student level outcomes (SLO). This research aimed to explore the implications of adopting a more superficial 'course' level of outcome (CLO), when reviewed against a reference set of external LO requirements.

Materials and methods: A purposive sample of 5 courses within the undergraduate dental programme was selected. The mapping of both SLOs and CLOs was reviewed in relation to their total number and the mapping connections to the reference outcomes.

Results: There was a mean reduction of 79% in outcomes when comparing SLOs to CLOs. The number of mapping connections between CLOs and the reference set reduced in 3 courses and increased in 2, when compared to SLOs.

Discussion: From a purely numerical perspective, changing the detail of learning outcomes has led to a change in mapping connections. As the delivered curriculum has remained unchanged, this demonstrates a potential impact of differing interpretations of learning outcomes. Further review of learning outcomes in relation to the domains categorised within the reference outcome document suggested more mapping links were obtained in clinically focused courses than academic or theoretical courses.

Conclusion: A demonstrable impact in mapping connections was observed when the detail within the learning outcomes was changed. This has implications for programme leaders in structuring LOs for a curriculum.

Introduction

Outcome based education theory was first described in the late 1980's (1). It differs from traditional educational models in that it defines the end product of a programme, rather than prescribing the process. In so doing, it offers opportunity for teachers and learners to determine their delivery and learning methods and explore varied educational experiences whilst moving the learner closer to achieving a set of predefined learning outcomes (LO).

Within educational literature the terms *learning outcome* and *learning or instructional objectives* are frequently interchanged (2). Harden describes *learning outcomes* as 'broad statements of what is achieved and assessed at the end of a course of study' (2) and *learning or instructional objectives*, as deconstructed learning outcomes which provide a more detailed specification. Tam alternatively uses the terms 'course level learning outcome' and 'student level learning outcomes' to describe these same concepts (3).

In deciding which level of description of learning outcomes to use, i.e. course level outcomes (CLO) or student level outcomes (SLO), providers need to consider the relative utility to different stakeholder groups such as learners, teachers and programme quality assurers. For example whilst student level learning outcomes may provide guidance to the teacher on how to deliver that element of the programme, there is a potential risk of becoming too prescriptive thereby restricting the student to a specific way of learning (2). Additionally, if using SLOs, providers are at risk of generating many hundreds of outcomes which are challenging to manage, maintain and quality assure in terms of delivery and assessment (4, 5), however in directing, and supporting the achievement of broader goals the SLO has arguably greater utility to the learner in providing the building blocks required to achieve that goal (3).

Background to the current study

The current Newcastle undergraduate dental (BDS) curriculum is partitioned into a series of courses; the established outcomes are described at the student level. The SLOs for all courses are mapped against the requirements of the UK's Regulator of Dental Professionals, the General Dental Council (GDC), in order that the programme can be accredited. The GDC requirements are described in the document 'Preparing for Practice: Dental team learning outcomes for registration' (6). In common with documents produced by dental organisations in other countries (7, 8), Preparing for Practice (PfP) presents a series of outcomes that describe the knowledge, attributes and skills expected of the graduating dentist. Student level outcomes were written and mapped by course leads and quality assured by a sub-group of the Board of Studies. The outcomes and their mapping are recorded in a custom developed electronic 'dynamic learning map' which is accessible by all staff members of the School (9).

When reviewing the programme as a whole the learning map identified over 1500 SLOs which whilst perceived beneficial to the learner, were identified by the Board of Studies as challenging with respect to maintaining currency, informing a strategy for teaching and assessment development, and quality assuring programme delivery.

In order to address this concern it was proposed that a tier of CLOs for use solely by the Board of Studies for quality enhancement and assurance purposes were written, whilst still maintaining the underpinning SLOs for the utility of learners and teachers. In undertaking this development no changes took place in the delivered curriculum.

It was theorised that as the CLOs were to be constructed from the underpinning SLOs it should be possible to describe the programme at either or both level of analysis, with no auditable change in the visible 'end product', however no worked examples testing this hypothesis could be found (2, 10). In light of this lack of evidence, and prior to implementing a large scale revision of documentation, the Board of Studies were concerned that personal interpretation and bias of course leads may influence the mapping of CLOs in such a way that when audited

via the CLOs the programme would no longer appear to meet the requirements of the external regulator. The aim of this research was therefore to consider whether an alternative hypothesis to Harden (2) may need to be considered by exploring the implications of adopting CLOs rather than SLOs for the same programme curriculum.

Materials & Methods

The Newcastle BDS programme has three different types of course: academic, clinical skills and clinical attachment (see Figure 1). A sample of five courses was included in this study. The sample was purposive thereby ensuring that each of the different type of course, as well as a course from each stage of the programme were represented in the analysis. Courses which were led by a member of either the research team or the mapping quality assurance team were excluded.

The leaders of each course were asked to write between 2-5 new CLOs by condensing the SLOs into broad statements of what is achieved and assessed at the end of their course; a worked example is provided in Table 1. As had been previously undertaken for the SLOs, course leads recorded and mapped these against the external reference set (the GDC's 'Preparing for Practice' (6)). This mapping was subsequently quality assured as previously. The mapping of SLOs and CLOs to the GDC reference document, was undertaken at different times (3 years apart) with no cross referencing by either the course leads or the quality assurance group.

The following data from the dynamic learning map were then recorded for each of the selected courses:

- The number of SLOs associated with each course
- The number of CLOs associated with each course
- The number of reference (GDC) LOs that were mapped to by SLOs

- The number of reference (GDC) LOs that were mapped by CLOs

The student level and course level learning outcomes were then compared in terms of:

- Number of LOs
- The coverage of reference (GDC) outcomes

A final review of these data, taking into consideration the nature of the learning outcomes, i.e. which of the four domains of the reference set (clinical, communication, professionalism, management and leadership) they related to, was also undertaken by the research team.

Results

The number of student level learning outcomes (SLOs) assigned to each course ranged between 7 and 44, with theoretical courses having more learning outcomes than either the clinical attachment or clinical skills course (Table 2). The number of course level learning outcomes (CLOs) ranged between 2 and 4. The mean difference in the number of learning outcomes from student level to course level represented a 79% reduction (range 57% to 91%). The courses with the greatest percentage changes were the theoretical courses.

The effect on the mapping of each course to the reference (GDC) outcomes when changing from student level to course level outcomes is also shown in Table 2. For theoretical courses, after moving from SLOs to CLOs, the mapping to the reference set of outcomes was approximately halved. By contrast, for the clinical skills course mapping to the reference set was slightly increased whereas there was a substantial increase in mapping for the clinical attachment course.

The mapping to the individual domains of the reference set of outcomes is shown in Table 3. The GDC domain most frequently mapped to was 'Clinical'. When grouping the courses by type, the effect of changing from SLOs to CLOs on mapping to the domains of the reference

outcomes was a universal decrease for theoretical courses. For the clinical attachment course, mapping in all domains increased, as did all but the 'Management and Leadership' domain in the clinical skills course.

Discussion

The number of learning outcomes listed for individual courses, should not be taken as a reflection of the contact time on those courses, and theoretical courses had the greatest number of SLOs despite having the least number of contact hours. The number of learning outcomes may therefore be associated more with the 'nature' of a course, and it is interesting to speculate why this might be. Whilst Miller (11) did not necessarily intend a pyramidal shape to signify a weighting or volume for the knowledge element of his theoretical model (11) for clinical competence, it is apparent from our experience of this that in order to develop clinical competence in even a relatively simple procedure, there are multiple discrete underpinning knowledge outcomes required. The model of Competency Based Education has a tendency to extensively deconstruct and fragment the knowledge, skills and behaviours required of a health care professional whilst at the same time failing to recognise the importance of their integration within the real world context of clinical practice. As a result competence based education in the context of vocational training has faced criticism (12). In some respects our use of SLOs could likewise be criticised, and perhaps in this regard CLOs provide a more meaningful expression of our intended goal in an authentic combined application of knowledge, skills and attitudes.

As theoretical courses started out with an overall greater number of SLOs it is perhaps inevitable that they showed the greatest percentage reduction when comparing to CLOs, remembering that course leads had been directed to write between 2-5 LOs at this level.

In comparing the extent of mapping to the reference set – differences were observed when comparing SLOs and CLOs for what is exactly the same delivered curriculum. The lack of intra-agreement by the course leaders may be explained by a number of factors. The original SLOs were mapped to the reference set in 2012 (shortly after publication of PfP) whereas the writing of CLOs took place some three years later. Whilst the course leads remained the same, and the same quality assurance processes were applied, in the intervening period it is probable that course leads will have developed an increasing awareness of the GDC LOs in PfP. In particular, they may have gained a heightened awareness of the learning outcomes that sit within the “newer” domains of Professionalism, Communication, and Management & Leadership. These are domains that had not featured quite so explicitly within the previous GDC outcomes document ‘The First Five Years’(13).

In writing the new CLOs we would suggest that despite there being no change in course content, that an element of unconscious bias may have been demonstrated by course leads, in that the contribution of their course to the hitherto relatively unknown LOs had been made more explicit. If this were the case we would expect to see that mapping to these three domains of Professionalism, Communication, and Management & Leadership should increase. This was the case for both the clinical skills course and the clinical attachment (with the exception of management & leadership in the clinical skills course) whereas the theoretical courses decreased in number in these domains.

Accepting the possible influence of realignment to the GDC LOs, the fact remains that within a programme course leaders are responsible for their learning outcomes. They should therefore have a deep working knowledge of the curriculum and the factors which may influence it. Inherent within this is the understanding that an individual will have of their particular course and the context in which they direct learning and teaching.

For a theoretical course, when writing outcomes at the course level, it may be that it was the application of foundation knowledge to clinical situations and the translation of that knowledge into clinical 'meaning', particularly in the context of 'soft skills' that may have been lost. This might be more exaggerated for the 'scientific/non-clinical' course leaders of theoretical courses who may not be able to see or justify the wider interpretation or clinical application of an outcome. Multiple and more detailed student level outcomes may therefore give theoretical courses a wider opportunity to make mapping more explicit to reference outcomes. The course level outcomes for the theoretical courses showed a tendency to focus on the underpinning specific 'scientific' focus of the outcome rather than its applications. We suggest that course leaders of theoretical courses may instinctively have a tighter focus on the purpose of their course and be less able to apply a wider interpretation, and accept a broader clinical context. Ten Cate and colleagues describe the concept of using 'entrustable professional activities' as a means of developing and assessing clinical competence (12). They identify the challenges medical educators face if they disregard the interplay between the learner and the clinical environment. Thus leaders of both clinical and theoretical courses who at times may lack insight into the environment of learners and what entrustment within that context 'looks like', may face the constraints of a non-applied framework, with a focus on 'knowledge' rather than the wider application of knowledge.

Nonetheless, the reference set of outcomes from PfP we applied have a strong clinical bias numerically, so inherently would seem to be more accessible to a clinical academic than a science based academic. Clinical academics might be thought to 'live' in both worlds of clinical and academic practise, exposed to a scientific basis and its clinical application. For a clinician-led clinical skills or clinical attachment course there is possibly an increased or wider interpretation written into the course level learning outcomes which may move more closely towards a description of an entrustable professional activity and thus lead to greater mapping to a predominantly clinical reference set of outcomes. Clinicians may therefore be applying an

increased 'context' in their interpretation and vocalisation of what the learning outcome actually encompasses. Considering the bigger picture, with less focus on mechanistic elements, it may become easier or there may be a loss of precision with broader 'outcomes'. This may give a greater scope for clinicians to interpret and enunciate the softer skills such as communication and patient management elements rather than contributory process steps. It would therefore be interesting to review courses that sit at the interface of clinical practice and underpinning science to see how individual clinicians working outside of a clinical environment in a non-clinical specialty behave.

Accrediting bodies such as the GDC require evidence that graduates have attained the required set of learning outcomes. Essentially the set of learning outcomes represent a declared curriculum, and yet the taught curriculum may vary significantly from this. Whilst acknowledging that learning outcomes form only a part of the curriculum it is important to consider the level of analysis of learning outcomes and the influence this may have. In reviewing a curriculum only through the 'LO window'(14), we are likely to limit the view, particularly if that window frame is small and we lack the wider perspective.

Conclusion

In changing from SLOs to CLOs there was a demonstrable change numerically in the mapping to the reference outcomes. The change appeared to be affected by the nature of the course and potentially by the nature of the course leaders.

In using a higher level of analysis of LOs the pattern of mapping appeared to change. For courses with a clinical focus this resulted in increasing links to the 'soft' clinical skills associated with all health care professionals, whereas for theoretical courses the links to this skill set became less explicit.

This work was based on Harden's model that institutional objectives were deconstructed learning outcomes. The reverse process, as described here is however less certain.

Programme leads and directors therefore should be mindful to the level of outcomes applied to learning and learning management. There are likely to be unexpected and unpredictable impacts and consequences that should require consideration.

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Theoretical (TC); where content is largely delivered through lecture/seminar/small group teaching, and is aimed at achieving understanding of underpinning knowledge.

Clinical Skills (CS); where content is largely delivered in a simulated clinical environment, aimed at enabling clinical skills development.

Clinical Attachment (CA); delivered through clinical practice on attachment to a specific clinical discipline. Aimed at providing opportunity for application of knowledge, and professional and clinical skill development in a workplace based setting.

Figure 1. Description of course styles within BDS programme at Newcastle University

GDC LOs* mapped via SLOs	Student Level Learning Outcomes (SLOs)	Course Level Learning Outcome (CLO)	GDC LOs* mapped via CLO
1.1.7	Describe the key functions of different nutrients	Discuss the relationship between diet, nutrition and oral health	1.1.5, 1.10.4, 1.10.7
1.1.4, 1.1.7, 1.10.7	List the main effects of deficiencies of specific nutrients		
1.1.5, 1.13.1	Describe the aetiology of enamel developmental defects, dental caries, dental erosion and periodontal diseases		
1.1.1, 1.1.2, 1.1.5, 1.1.12	Critically appraise the evidence for the role of diet in the aetiology of dental caries with reference to a range of studies (epidemiological, (intervention, cohort, population based studies), animal experiments, plaque pH studies)		
1.1.1, 1.1.2, 1.1.12	Critically appraise the evidence for an association between tooth loss (edentulism) and diet and nutritional status		
1.10.4	Outline the arguments for the use of non-sugar sweeteners for caries prevention		
1.1.5	Describe the applications and limitations of foods and factors in the diet that protect against dental caries		

*GDC LOs are recorded numerically and are available at <http://www.gdc-uk.org/Newsandpublications/Publications/Publications/GDC%20Learning%20Outcomes.pdf>

Table 1. Table to demonstrate the structural relationship between CLOs, SLOs and GDC outcomes in a worked example

Stage	Course type	Student Level Outcomes		Course Level Outcomes		Effect of changing from SLO to CLO	
		No. of LOs	Number of GDC LOs mapped	No. of LOs	Number of GDC LOs mapped	% change in no. of LOs	
1	Theoretical	26	16	3	5	-88	
2	Theoretical	18	16	3	7	-83	
3	Clinical Skills	8	18	2	22	-75	
3 & 4	Clinical Attachment	7	7	3	33	-57	
3, 4, 5	Theoretical	44	22	4	12	-91	

Table 2. Number of outcomes and mapping to external reference (GDC) outcomes

Course type	Domain	Student Level Learning Outcomes	Course Level Learning Outcomes	Effect of changing from SLO to CLO
		Total number of GDC LOs mapped	Total number of GDC LOs mapped	GDC LOs now mapped
Theoretical	Clinical	42	23	LESS
	Communication	4	1	LESS
	Professionalism	4	0	LESS
	Management & Leadership	4	0	LESS
Clinical Skills	Clinical	12	14	MORE
	Communication	0	2	MORE
	Professionalism	3	4	MORE
	Management & Leadership	3	2	LESS
Clinical Attachment	Clinical	5	23	MORE
	Communication	1	4	MORE
	Professionalism	1	4	MORE
	Management & Leadership	0	2	MORE

Table 3. Effect of changing level of outcome on reference outcome domains